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TAXONOMY OF *SOLIDAGO VELUTINA* (ASTERACEAE: ASTEREAE) WITH A NEW, RELATED SPECIES FROM MÉXICO

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ABSTRACT

Solidago velutina DC. is a wide ranging species of México and the western United States that includes plants previously identified primarily as *S. sparsiflora* A. Gray, *S. californica* Nutt. and *S. scabrida* DC. *Solidago mollis* Bartling is also very similar and may prove to be conspecific. A morphological description of *S. velutina* is presented, based on specimens from its entire geographical range. **Solidago macvaughii** is proposed as a new species closely related to *S. velutina*; the new species apparently is endemic to northeastern Aguascalientes, México, where it is completely allopatric with its close relative.

KEY WORDS: *Solidago*, Asteraceae, Astereae, México.

Solidago velutina DC. is the most widespread and commonly collected species of *Solidago* in México. It is also widely distributed in the western United States, where it has been known by a number of names, for the most part summarized with typification by Taylor & Taylor (1984). In recent floristic treatments, it has been identified primarily as *S. sparsiflora* A. Gray. Taylor & Taylor (1984) were apparently the first to recognize the conspecific nature of the United States plants with the common Mexican species.

I can find no characters to separate *Solidago velutina* from what is called *S. californica* Nutt., commonly identified in the western United States, and I add this species to the list of synonyms of the former. Taylor & Taylor (1984) noted that *S. velutina* "varies considerably in morphology" but provided no rationale for their recognition of the plants from Nevada to Texas as a variety of typical *S. velutina* and no explanation of why they placed the variety as a part of *S. velutina* rather than *S. californica*. Keck (1959) considered *S. californica* var. *nevadensis* to be a synonym of *S. californica*.

The description below is drawn from specimens of *Solidago velutina* over its entire range, except for Oregon. At least one count of ray and disc flowers is included for each state cited below. The synonymy may be incomplete, but it includes at least the primary names that have been used for the species. Except for the inclusion of *S. californica* and *S. scabrida*, the list is essentially the same as given by Taylor & Taylor (1984).

Solidago velutina DC., Prodr. 5:332. 1836. TYPE: MÉXICO. México: Near México City, *Berlandier 930* (HOLOTYPE: G-DC, fiche!).

S. scabrida DC., Prodr. 5:331. 1836. TYPE: MÉXICO. Locality unspecified, but probably México or Hidalgo, *Alaman s.n.* (HOLOTYPE: G-DC, fiche!). (See discussion below).

S. californica Nutt., Trans. Amer. Philos. Soc. ser. 2. 7:328. 1841. TYPE: UNITED STATES. California: Near Santa Barbara, 1834-1835, *Nuttall s.n.* (HOLOTYPE: PH, fiche!).

S. californica Nutt. var. *nevadensis* A. Gray, Botany Calif. 1:319. 1876. TYPE: UNITED STATES. Nevada: Carson City, 1865, *Anderson s.n.* (HOLOTYPE: GH). *S. velutina* var. *nevadensis* (A. Gray) C. & J. Taylor, Sida 10:246. 1984.

S. californica Nutt. var. *aperta* Henderson, Rhodora 32:28. 1930. TYPE. UNITED STATES. Oregon: Below Selma, 15 mi down the Illinois River, 18 Jun 1926, *Henderson 7073* (HOLOTYPE: ORE).

S. sparsiflora A. Gray, Proc. Amer. Acad. Arts 12:58. 1874. TYPE: UNITED STATES. Arizona: Near Camp Lowell, 1874, *Rothrock 706* (HOLOTYPE: GH; Isotype: US).

S. sparsiflora A. Gray var. *subcinerea* A. Gray, Proc. Amer. Acad. Arts 17:197. 1882. TYPE: UNITED STATES. Arizona: Rucker Valley, *Lemmon s.n.* (HOLOTYPE: GH).

S. canadensis var. *arizonica* A. Gray, Proc. Amer. Acad. Arts 17:197. 1882. TYPE: UNITED STATES. Arizona: Boulder Creek, 1874, *Rothrock 782* (HOLOTYPE: GH; Isotype: US). *S. arizonica* (A. Gray) Woot. & Standl., Contr. U.S. Natl. Herb. 16:181. 1913.

S. trinervata E. Greene, Pittonia 3:100. 1896. TYPE: UNITED STATES. Colorado: Gunnison Canyon, 18 Aug 1896, *E.L. Greene s.n.* (LECTOTYPE [Taylor & Taylor 1984]: ND).

S. garrettii Rydb., Bull. New York Bot. Gard. 37:134. 1910. TYPE: UNITED STATES. Utah: Big Cottonwood Canyon, 28 Aug 1906, *Garrett 2041* (HOLOTYPE: NY). *Fide* Welsh, 1983.

S. howellii Woot. & Standl., Contr. U.S. Natl. Herb. 16:181. 1913. TYPE: UNITED STATES. New Mexico: Sierra Grande, 15 Aug 1903, *Howell 219* (HOLOTYPE: US).

Rhizomatous perennials. Stems mostly 0.3-1.1 m tall, hispid hirtellous to short villous-puberulent above and below, the hairs often spreading crinkly, sometimes slightly deflexed, scattered plants with antrorsely ascending or appressed hairs. Leaves scabrous ciliate, sparsely to densely and evenly hispidu-

lous hirtellous on both surfaces, 3 veined, the basal and lower cauline oblanceolate to elliptic lanceolate, ovate, or spatulate, entire to very shallowly crenulate, serrate, or mucronulate with 5-7(-14) pairs of teeth, 4-10(-12) cm long, 7-25(-35) mm wide, often early deciduous, gradually reduced upwards, sharply so just below the capitulescence. Heads secund on recurved branches, the capitulescence columnar to ovoid or pyramidal, rarely broadly so; phyllaries glabrous to sparsely short strigose, strongly graduated in 3-5 series, narrowly triangular lanceolate to oblong lanceolate with acute or less commonly obtuse apices, the inner 3.5-5.0 mm long, the midvein prominently orange resinous, usually raised and often broadened near the apex, the lamina mostly whitish indurated but thin, slightly greenish at the tips, with a narrow, hyaline, sometimes minutely lacerate ciliate margin; receptacles smooth to shallowly foveolate. Ray flowers 7-9(-12)[-13], the ligules 1.5-3.0 mm long. Disc flowers [4-]5-9(-11), 3.5-4.5 mm long. Achenes 1.8-2.5 mm long, strigose, 5(-8) nerved; pappus of 40-45 bristles in several series about as high as the disc corollas. Chromosome number, $n=9$ pairs.

Baja Califórnia Norte, Sonora, Chihuahua, Durango, Coahuila, Nuevo León, Tamaulipas, San Luis Potosí, Zacatecas, Hidalgo, Edo. México (the type), southern Oregon, California, Nevada, Utah, Colorado, Wyoming, Montana, Arizona, New Mexico, trans-Pecos Texas to Oklahoma; greasewood-mesquite, grasslands, chaparral, oak, oak-pine and pine woodlands, sometimes with Douglas fir; 1400-2550 m in México, ca 100-2600 m in the United States; May-November (-December).

As observed by McVaugh (1984), *Solidago velutina* appears to be rapidly spreading on the central plateau of México. It is not eaten by grazing animals, apparently not even by sheep or goats, and is certain to become a more abundant and conspicuous species in México, particularly along the roadsides.

McVaugh (1984) adopted *Solidago scabrida* DC. as the name for *S. velutina*, but the type of *S. scabrida* was described by De Candolle as having basally glabrous stems and leaves scabrous on the veins and margins. In its diagnosis De Candolle compared *S. scabrida* to *S. canadensis*. In contrast, the type of *S. velutina* is "tota pube brevi conferta pulverulento-velutina" (Prodr. 5:332. 1836) and clearly matches the indument of the species widespread in México. I believe that the specimen of *S. scabrida* probably is of hybrid origin between *S. velutina* and *S. paniculata* DC., the only other species of *Solidago* near México City, where it is most likely that Alaman collected, that resembles *S. canadensis* in habit. *Solidago paniculata* has glabrous stems except for slender lines of hairs in the capitulescence.

Solidago velutina is variable but usually identified without much difficulty by its relatively short stature, stems with spreading pubescence, mostly obovate and usually entire leaves that are sharply reduced below the capitulescence and equally hairy above and beneath, typically pyramidal capitulescence, and relatively constant number of ray and disc flowers. The counts of flowers by

Keck (1959) in California increase my summary of the range of ray flowers to 13 and decrease the range of disc flowers to 4.

Plants of *Solidago velutina* with appressed stem pubescence have been collected nearly throughout the range of the species (Baja Califórnia Norte, Chihuahua, Coahuila, Nuevo León, Hidalgo, as well as California, Nevada and Texas). In most other respects, these forms appear to be typical of the species, but some features of their vestiture, leaf shape and capitulescence (different from area to area) suggest they may be hybrids or introgressants. Typical *S. velutina* is known from Baja Califórnia Norte, but from the Sierra San Pedro Martír, a number of collections have been made of plants, similar among themselves, with appressed stem pubescence and lanceolate leaves with acuminate apices. A similar situation exists in southwest Texas, where plants of *S. velutina* with appressed stem pubescence but with rounded leaf apices are common.

With the exception of the new species proposed below, there are apparently no species in México closely related to *Solidago velutina*, although it may occasionally hybridize with several, morphologically divergent ones there. Taylor & Taylor (1984) noted that *S. velutina* is closely allied with *S. radula* Nutt. and *S. mollis* Bartling of the eastern United States and with *S. californica*. Also included in this group of close relatives is *S. nemoralis* Ait. of the eastern United States. According to Taylor & Taylor (1984), the latter and *S. mollis* are set apart from the others by 1 nerved leaves (but see comments below). All of these taxa appear to be virtually identical in involucral and floral features, at least where their ranges meet in the midwestern United States.

Taylor & Taylor (1984) narrowed the definition of *Solidago mollis* to a narrow endemic of northern Texas and adjacent Oklahoma. Their key separates it from *S. velutina* by its 1 nerved leaves, but their short discussion notes that *S. mollis* has "3-ribbed" leaves; specimens in LL and TEX annotated by them include plants with 1 nerved and 3 nerved leaves. As indicated by comments by M.C. Johnston (1970) and his annotations, some of these plants seem to combine characters of *S. nemoralis* and other species, perhaps *S. missouriensis* Nutt. and *S. petiolaris* Ait., as well as *S. velutina*. Barkley (1986) in contrast, described *S. mollis* as "prominently 3-nerved" and as "one of our most distinctive goldenrods, rarely to be confused with any other." There is little in Barkley's description of *S. mollis*, however, besides the "early-deciduous lower leaves" to separate it from *S. velutina* in the Great Plains, although in the key, he noted that *S. velutina* has involucral bracts with distinctly acute tips vs the rounded to weakly acutish tips of *S. mollis*. Early deciduous lower leaves are common in *S. velutina* throughout most of its range. Weber (1976) used stem height and relative leaf width (narrowly vs broadly oblanceolate) to distinguish *S. mollis* from *S. velutina* in Colorado. Plants in LL and TEX identified as *S. mollis* from Colorado, Montana and Wyoming in my judgment, are indistinguishable from *S. velutina*. Slightly further east, related plants tend

to have thicker leaves with coarser pubescence and at least some fasciculate leaves near the capitulescence, *S. nemoralis*-like features.

Martin & Hutchins (1981) distinguished *S. mollis*, as well as *Solidago howellii* Woot. & Standl., from *S. velutina* on the basis of "ovate to oblong" phyllaries vs "linear to linear-lanceolate" ones, but of numerous *S. velutina*-like specimens from eastern New Mexico that I have examined, none could be placed in a species separate from *S. velutina*.

A more detailed and inclusive study may eventually show *Solidago mollis* (Bartling, Ind. Sem. Hort. Gotting. 5. 1836) to be the earliest name for the species that includes *S. velutina*. Both names were published in 1836, *Solidago velutina* in "early October 1836" (TL2), but I have not located a more specific date for *S. mollis*. *Solidago nemoralis* (Ait., Hort. Kew. 3:213. 1789) is the oldest name among all the species in the complex.

Taylor & Taylor (1984) speculated that *Solidago canadensis* var. *canescens* A. Gray is more closely related to *S. velutina* than to *S. canadensis*. In contrast, I find that the former, which occurs in Texas and northern México, is indeed part of the *S. canadensis* complex, where it fits in habit, vestiture, and details of involucral and floral morphology (Nesom in prep.).

A new species related to *Solidago velutina*.

McVaugh (1984) included a single species in his treatment of *Solidago* from Nueva Galicia, México, and he identified it as *S. scabrida* (=*S. velutina*). He noted that the widespread form of the species in México was "apparently the same species, but perhaps a form slightly different from ours ... ." The specimens he cited are different in several significant ways from *S. velutina* over its entire range, and I recognize them as a distinct species.

Solidago macvaughii Nesom, *spec. nov.* TYPE: MÉXICO. Aguascalientes: [Mpio. Rincón de Romos], 2 km S and 2 km E of Rincón de Romos, low, ungrazed meadow with some permanent wet places, [wet meadow with nearly permanent springs,] 2000 m, local in patches near the road, 4 Sep 1967, *R. McVaugh 23663* (HOLOTYPE: MICH!–illustrated in McVaugh 1984, p. 855).

S. velutinae DC. habitu et capitulescentia similis sed differt caulibus purpuratis glabratis in partibus infernis, foliis serratulis, phyllariis textura tenuioribus sine costis aurantiaci-resinosis oblongi-oblanceolatis apicibus spathulatis.

Perennials from short, fibrous-rooted rhizomes, spreading by slender stolons. Stems 0.7-1.0 m tall, glabrate on the lower part, moderately hispid hirtellous to puberulent above, the hairs spreading crinkly, sometimes slightly deflexed.

Leaves scabrous ciliate, sparsely to densely and evenly hispidulous hirtellous on both surfaces to nearly glabrous, sometimes also minutely granular glandular, the cauline numerous (ca 30-50), the lower 4-7 cm long, 6-15 mm wide, oblanceolate, epetiolate, 3 nerved, serrulate with 9-15 pairs of mucronulate teeth, gradually reduced upwards, the middle and upper mostly 1.5-3.0 cm long, entire or nearly so, 1 nerved. Heads secund on slightly recurved branches, in a broadly pyramidal capitulescence 5-9 cm wide; phyllaries glabrous, strongly graduated in 3-5 series, the outer lanceolate to oblong lanceolate with acute to obtuse apices, the inner narrowly oblong oblanceolate with rounded spatulate apices, 3.5-4.5 mm long, the midvein greenish, not at all broadened near the apex or raised, the lamina very thin, with a broad, shallowly lacerate ciliate, hyaline margin extending around the margins and apex; receptacles deeply foveolate. Ray flowers 15-27, the ligules 1.5-2.5 mm long with toothed to deeply lobed apices; tube longer than the ligule. Disc flowers 8-14, the corollas 4.0-4.5 mm long. Achenes sparsely strigose, narrowly oblong, basally attenuate, mature size not observed; pappus of ca 30-40 bristles 2.5-3.5 mm long. Chromosome number unknown.

Additional collection examined: MÉXICO. Aguascalientes: [Mpio. Asientos], near Cienaga Grande, grassy pastured flats along a watercourse, 2000 m, locally abundant, 8 Sep 1967, *McVaugh 23784* (MICH).

As observed by McVaugh, these plants are very similar to *Solidago velutina*, particularly in their habit, capitulescence and vestiture, but they differ in a number of ways from all plants of the latter over its whole range. *Solidago macvaughii* is known only from the two collections in northeastern Aguascalientes, which is below the southern edge of the range of *S. velutina*; no collections of the latter have been made in Aguascalientes. The two species are further contrasted by the following couplet.

1. Habitats dry; stems greenish, evenly pubescent; leaves usually entire, occasionally shallowly serrate with 5-7(-14) pairs of teeth; inner phyllaries triangular lanceolate with definitely narrowed, acute to obtuse apices, with prominently orange resinous and raised midveins; ray flowers 7-9 (-12); disc flowers (4-)5-9(-11) ..... *S. velutina*

1. Habitats wet; stems purplish, glabrate below, puberulent above; leaves serrulate with 9-15 pairs of teeth; inner phyllaries oblong oblanceolate with broadened, rounded apices, with greenish, non-raised midveins; ray flowers 15-27; disc flowers 8-14 ..... *S. macvaughii*

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